Utilizing RTX RTOS Platform to Revolutionize Digital Audio Workstations

The Market & Customer Profile

HMerging Technologies builds state-of-the-art digital audio and video recording and mixing equipment for professional applications that require precise and synchronized playback for a wide array of uses including theater; live events; TV and radio broadcasts; feature film production and post-production; outside broadcast vans; museums; kiosks and corporate events. Notably, Merging Technologies' Pyramix is acknowledged as the audio industry's most advanced Digital Audio Workstation (DAW).

Generally speaking, a DAW is a PC or Macintosh equipped with sound cards and/or software for editing and processing digital audio. A properly outfitted PC workstation functions like a sophisticated recording studio, using plug-ins and special software to create recording-studio quality sound on the desktop, and then allowing users to edit and process that sound to perfection. DAWs are not only revolutionizing the way music is recorded, but also enabling new forms of electronic music to be written, created and recorded on the desktop.

In a world of PC or Mac-based DAWs that generally use rendered processing technologies, Pyramix offers more advanced real-time processing, making its editing model and speed far more efficient and capable.

Pyramix's real-time processing delivers unsurpassed sonic quality and a level of flexibility that provides a competitive edge in post-production, multi-channel live music recording, broadcast radio, and CD/SACD music mastering. It is one of many differentiating features that drive broadcasters, film and TV post houses, as well as music and mastering professionals worldwide, to select Pyramix.

Merging's MassCore™ mixing engine is based on IntervalZero's RTX software, which transforms Windows into a real-time operating system (RTOS). Its capabilities clearly set Merging apart from all the other DAWs vendors and make Pyramix a viable and compelling solution for even the very high end of the audio processing market.

Digital Audio Workstation Industry and Merging Technologies' Challenges

The purpose of a DAW is to capture analog sounds, convert them to digital recorded sounds, freely manipulate these recorded sounds, and reproduce the mixed, digital sounds as if they were delivered in an analog form.

Professional DAWs demand the performance and precision of hard real-time systems in order to deliver that analog-sounding result. In other words, real-time system performance reproduces better quality mixes.

A DAWs OEM faces several design constraints that impact performance. More competitive products

deliver support for more channels; more input channels and more output buses; faster conversion from analog to digital (and back); more complex real-time sound processing such as filtering, equalizing, reverberation, and pitch manipulation; but most importantly lower latency on live-in to live-out overall processing. All this, while maintaining total reliability

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Claude Cellier
President of Merging Technologies

on deterministic input-to-output processing. A single audio sample lost (or duplicated) can be both extremely noticeable and annoying to the human ear and can never be tolerated in a professional system.

The technical challenge for Merging Technologies, or any OEM, is to strike a balance between software and hardware in order to optimize the ability to manage the permutations of channels, buses, frequencies and still deliver the ultimate in sonic quality with the least amount of hardware customization and cost.

Traditionally, professional DAWs, including Merging Technologies products, have relied on add-in DSP and FPGA-based boards to handle the hard real-time processing to enable the signal collection, analog-to-digital conversion and manipulation of all the sounds. The host operating system, either Windows or MAC, was largely used to deliver the user experience.

And while DSPs and FPGAs offered a way for professional DAWs OEMs to differentiate previously, the increasing demands for real-time performance continue to grow and price pressures continue to mount. A plug-in board with a single DSP can no longer offer a sufficiently differentiated solution for the DAWs OEM to remain competitive. Some OEMs have tried to manage exotic arrays of DSPs or have moved to FPGAs. Both add significant complexity and add costs in maintenance and productivity because it is so difficult to implement any new feature.

A new challenge has emerged for DAWs OEMs with the introduction of Intel's powerful, but often underutilized multicore x86 processors. Merging wants its customers to be able to supply their own PC workstations and saw a real opportunity to capitalize on the underutilized multicore computing power. Rather than have a duocore or quadcore workstation system with multiple cores sitting idle while an expensive plug-in card did the work, Merging recognized that if they could find a way to perform the real-time calculations on the idle cores, they would have a considerable market advantage.

In fact, they felt that the ideal solution for a next-generation professional DAW could be software-only. Currently, Microsoft Windows and Apple Mac OS do not offer a real-time capability, which is required to produce professional-grade user experience. Merging sought a real-time extension that would allow Windows to run on one core and have the real-time components run unimpeded on other cores.

In addition to these technical challenges, Merging saw some business benefit if they could pursue an off-the-shelf, all-software solution based on Microsoft Windows. Most importantly, the time-to-market for new features, new products or maintenance releases would be dramatically shortened. Additionally, they could consolidate to a single development environment rather than having a development tool chain for the user interface and mixer, and a separate tool chain to program DSPs and FPGAs. The development environment could rely on a high-level IDE like Visual Studio rather than DSP assembly-like languages. Customers could buy upgrades or install patches just by downloading software rather than replacing boards.

The IntervalZero Solution

In the end, Merging was able to create a software-only, real-time audio mixing engine with IntervalZero's SMP-enabled RTX. The mixing engine sets a new standard for state-of-the art and is capable of handling a range of mixing options.

It can be configured from just 16 to an astonishing 384 simultaneous live input and output channels (768 I/O) at 48kHz, or at 256 channels through the mix bus into a massive 256 channel mix-bus structure. Additionally, it retains an almost infinite number of real-time editing (virtual) tracks and with latencies far lower than any other Windows or Mac based system.

All processing is done in floating point, so the accuracy is also on par with the best existing professional DAWs. The solution offers a level of power, sonic quality and flexibility that outperforms every other DAW on the market.

Merging Technologies' Pyramix MassCore™ is written to run on RTX. MassCore uses RTX capabilities to move the hard real-time control logic, such as I/O or sampling logic, from specialized hardware components to software components. The software runs on multi-core, industrial-strength commodity x86 processors and uses both Open Standards and Standard Communications Architecture, such as USB and real-time Ethernet.

Porting the existing DSP-based engine to RTX to create the MassCore engine running natively on Intel multi-core chips was straight forward because of the C/C++ code base. Merging Technologies already had experience with Microsoft Windows and Visual Studio, eliminating the need to learn a new development environment as would have been the case had they gone with a closed, proprietary hardware solution.

Now that MassCore relies on on Microsoft Windows, multiprocessor chips (Intel multi-core) and IntervalZero RTX, Merging is on a platform that is scalable, open and here to stay.

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In summary, Merging has developed a breakthrough technology to deliver unprecedented results for Professional DAWs, and is poised for rapid growth. Their competitive advantage is that they do not have to fuss with hardware, but can deliver hardware-like results on a platform that leverages IntervalZero's RTX.

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"We could never have dreamed our experience with IntervalZero's RTX would be such a success. When we decided to go the RTX route, we had well over a dozen years experience with DSPs, and while DSP chips were enjoying steady improvements and faster clocks year after year, switching to Intel-based hardware just made us realize how Moore's law can be so much steeper when conducted by Intel's phenomenal acceleration."

Interval**Zero**

www.IntervalZero.com

In US
sales@intervalzero.com

In EMEA
Fabrice.Boisset@intervalzero.com

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